

T178
W3
1914
COPY 2

The Institute of Industrial Research

Washington, D. C.

Scope and Organization



WASHINGTON, D. C.

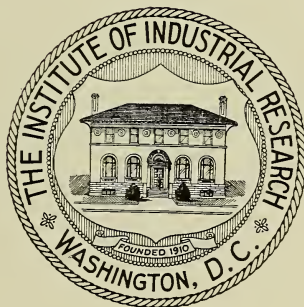
AUGUST, 1914

The Institute of Industrial Research

Washington, D. C.

Established December 1, 1910

Scope and Organization



WASHINGTON, D. C.

AUGUST, 1914



THE INSTITUTE OF INDUSTRIAL RESEARCH
CORNER 19TH AND B STREETS N. W., WASHINGTON, D. C.

By THE
APR 7 1917

PRESENT ORGANIZATION OF THE INSTITUTE

ALLERTON S. CUSHMAN, A.M., Ph.D., Director
HENRY A. GARDNER, Assistant Director
N. MONROE HOPKINS, M.S., Ph.D., Electrical Engineer
CHAS. A. CRAMPTON, M.D., Ph.C., Food and Drug Expert
GEORGE W. COGGESHALL, Ph.D., Chemical Engineer
PRÉVOST HUBBARD, Chemical Engineer
H. C. FULLER, B.S., Drug Expert
THOMAS M. RECTOR, Bacteriologist
W. GLEN ABBOTT, Asst. Asphalt Chemist

Assistant Analysts

LOUIS G. CARMICK, B.S. LELAND P. HART
WILLIAM J. MONRAN

P. H. BUTLER, Secretary and Treasurer
WILLIAM H. BECK, Assistant Secretary

BOARD OF TRUSTEES

ALLERTON S. CUSHMAN, President
HENRY A. GARDNER, Vice-President
CHARLES A. CRAMPTON
GEORGE W. COGGESHALL
PRÉVOST HUBBARD, Secretary
HENRY C. FULLER
WILLIAM B. HIBBS

PREFACE TO THE FOURTH EDITION

The great success of the idea embodied in the scope and purpose of this Institute and the great industrial achievements of some of our principal clients have not been attained without arousing the jealousy and antagonism of some competing interests. Inspired by their own motives, certain persons have alleged in a public manner that the Institute building was constructed in a prominent part of the City of Washington, facing a beautiful Government reservation and park, with the sole purpose in view of producing the impression across the country that the Institute was a branch of the Government service and therefore qualified to speak with Government authority on many of the problems coming within its scope. It has also been alleged that the bulletins of this Institute are designed on purpose to further this impression and are issued so as to closely imitate the publications put out by the various scientific bureaus and departments of the Government service. It has also been stated that the Institute, its building and its organization are owned and supported by special interests in this country.

In issuing this fourth edition of our Bulletin No. 3, describing the scope and organization of the Institute, we take occasion to correct these statements which we consider to be of an unjustifiable and malicious nature. Like other similar organizations, we depend for our support upon fees and retainers in payment for service rendered. If a widely spread impression were to get abroad that this Institute was, either directly or indirectly, under the control of the United States Government, corporations or persons desiring such services as can be rendered by the Institute would not know that our organization was available to them and would seek to have their work done elsewhere. The statement that the Institute has endeavored to masquerade as a Government foundation is therefore manifestly absurd.

The fact that our bulletins are published with the same order of dignity and accuracy as has always been the prac-

tice in the scientific bureaus of the Government is due only to the fact that nearly all of the heads of divisions on the Institute staff have been trained for many years in the Government service and have been at one time or another in charge of the issue of Government reports and publications. We desire to emphasize the fact at this place that The Institute of Industrial Research has no connection whatsoever with any branch of the Government, although its reports and publications are as carefully and accurately prepared as scientific possibilities permit. We also take this occasion to state that the Institute is not controlled or guided by any special interests whatsoever, either in this country or abroad. Statements that any persons or corporations cannot get fair and accurate scientific investigation and reports at this Institute are without foundation and are maliciously put forward in the attempt to promote private gain.

PLAN AND SCOPE OF THE INSTITUTE

THE INSTITUTE OF INDUSTRIAL RESEARCH was founded by Allerton S. Cushman, Henry A. Gardner and N. Monroe Hopkins, December 1, 1910, as a company duly incorporated under the laws of the District of Columbia. The articles of incorporation declare that the objects of the corporation shall be:

"1. To investigate and improve processes of manufacture and to cooperate with manufacturers in the reduction of costs and the utilization of by-products and waste.

"2. To investigate and improve general metallurgical, mining and agricultural operations, so as to improve their efficiency and to disseminate information in regard to such improvements.

"3. To study the problems of paint technology, electrical engineering, and electrochemistry; and to institute economies and improvements in the manufacture of fertilizers and general chemicals.

"4. To train and instruct graduates of scientific and technical schools and other qualified persons in industrial research, and to aid them in obtaining work for which they are particularly fitted; and in general to do and perform every lawful act and thing necessary or expedient to be done or performed for the efficient and profitable conducting of said business, as authorized by the Laws of Congress, and to have and exercise all powers conferred by the laws of the District of Columbia upon said corporation."

The articles of incorporation were purposely drawn so as to provide for the expansion and development of the Institute's work on the broadest possible lines. The branches of the work which have been given the most attention include metallurgical problems, with especial reference to the protection and conservation of the industrial metals; agricultural chemistry, land and fertilizer problems; paint technology in all its branches; food and drug problems with especial reference to the interpretation and compliance with Federal and State legislation; chemical

industry, including the improvement and extension of present processes and the development of new ones; road building and paving problems with especial reference to specifications, inspections, advice and investigations in co-operation with municipalities and other corporations or individuals who desire to retain expert assistance, with chemical and mechanical testing and examination. Electrochemistry and electrical and chemical engineering in general is also made a strong specialty. Patents and their development have proved to offer a field in which the services of the Institute have been useful. Although the Institute does not undertake to do the work of patent solicitors or attorneys, its location in the City of Washington and its broad equipment for investigation enables patent attorneys and inventors to avail themselves of special facilities for working out their problems.

The organization of the Institute is built up on the same plan as some of the scientific bureaus of the Federal Government, in which most of the Divisional Chiefs received their training through many years of official service. The Institute, however, is quite independent of the Government, and is supported entirely by fees and retainers received from clients for service rendered. Ordinary commercial analytical work and testing is carried on to a limited extent, although it is not a principal object of the Institute unless the results sought have a direct bearing on important development problems.

Although research must be essentially scientific and carried on along scientific lines, the intention is to interpret all results obtained in a practical way, so that they will be useful to manufacturers and others who avail themselves of the advantages that the work of the Institute offers.

Many of the great industrial associations of the United States have been within the last few years carrying on research work as a business asset. It is naturally more economical for such associations to avail themselves of an organization and equipment already complete than to establish and endow their own laboratories. Already several of the most important representative organizations

have completed arrangements with the Institute to carry on research work in their respective lines, and the results obtained have fully justified this cooperation.

The laboratories and offices of the Institute are admirably housed in a new and specially designed building which is located on a beautiful site facing on Potomac Park at 19th and B Streets Northwest. It is very near the Pan American Union building and about five minutes walk from the White House.

The building contains a large lecture hall, which also serves the purpose of a library and demonstration room. It is equipped with lantern Balopticon and projector. This room is available without charge as a meeting place for technical committees of various learned societies meeting in Washington.

The description of the various laboratories and their equipment will be found under the chapter describing the separate divisions of the work.



LIBRARY, LECTURE, AND DEMONSTRATION HALL

DIVISION OF METALLURGY

ALLERTON S. CUSHMAN, A. M., Ph.D., in Charge of Division

THE DIVISION OF METALLURGY is prepared to undertake work in all problems in the line of metallurgy, including the mining, chemistry and evaluation of fuels and industrial minerals. Special attention and study have been given to corrosion problems and methods of overcoming these difficulties. Although not strictly speaking a metallurgical problem, examinations and reports on water supplies are handled in this Division. This work is taken up in both the sanitary and industrial phases of the subject, and includes sewage and drainage problems. In many cases the rapid corrosion of boilers and metallic containers is principally due to the character of the water supply, which may easily be modified by proper treatment. Refrigeration engineering and boiler practice introduce a number of problems which only the trained chemical engineer, with a full laboratory equipment at his service, can hope to solve. The conservation of metals and minerals of all kinds, the utilization of by-products and saving of wastes are among the subjects of great importance, on which the advice and work of this Division is frequently called for.

The Division of Metallurgy is under the direction of Dr. Allerton S. Cushman, assisted by the general staff of the Institute. Dr. Cushman took his Bachelor's degree in chemistry at the Worcester Polytechnic Institute, under Professor Leonard Kinnicutt, in 1888. He then went to Germany and studied metallurgy under Professors Richter and Ledebur, at the Royal School of Mines in Freiberg, Saxony. He also studied for a time in the laboratory under the celebrated Professor Bunsen, at Heidelberg University, Bavaria. After some years' professional practice and teaching in the West, he went to Harvard University,

where he took his Master's and Doctor's degrees, under Professors Jackson, Hill and Theodore Richards. For three years Dr. Cushman worked under Dr. H. W. Wiley in the United States Bureau of Chemistry, and was then made Assistant Director of the United States Office of Public Roads in Charge of Chemical and Physical Investigations, which position he held for six years until November, 1910.

DIVISION OF PAINT TECHNOLOGY

HENRY A. GARDNER, in Charge of Division

THE DIVISION OF PAINT TECHNOLOGY is under the direction of Mr. Henry A. Gardner, Assistant Director of the Institute, who is well known as a writer and authority on paint problems. Mr. Gardner has acted as Director of the Scientific Section of the Paint Manufacturers' Association of the U. S., and has been for many years in charge of the experimental work that has been carried on by this Association. This work, which now forms one of the chief activities of this Division, is being



CORNER OF PAINT TESTING LABORATORY

continued under Mr. Gardner's supervision in the specially designed and thoroughly equipped paint laboratories of the Institute, where every facility is afforded for its prosecution in a thoroughly practical as well as scientific manner.

The extensive exposure tests in different sections of this country, which were designed to determine the comparative merits of protective coatings and paint products for various structural materials, are being continued and inspected

from time to time in order that reports and bulletins may be issued and information distributed. Additional systematic exposure tests have recently been undertaken by this Division on the Institute grounds at Washington, in conjunction with important laboratory researches to determine the physical and chemical properties of oils and oil mixtures.



PAINT TESTS ON GROUNDS OF THE INSTITUTE OF INDUSTRIAL RESEARCH

These tests are made upon Panels of Wood, Steel, and Cement. Several hundred different kinds of Paints and Paint Products are being tested in this practical fashion.

This Division does not undertake the examination or commercial analysis of proprietary brands of paint or varnishes, with the object of furnishing reports or certificates regarding their comparative value or relative durability. The Division is, however, in a position to carry on research work to determine the usefulness of various products as paint constituents. Various materials which appear not to be suited for certain specific uses, and regarding which

there is little information on record, are often found upon investigation to be subject to treatment that renders them satisfactory, or they may be found to possess characteristics which make them of great value in certain lines of manufacture. Study of such products, with a view to working out methods for their utilization, will be undertaken.

Advice to engineers, architects or painters regarding the better types of protective coatings for the exterior or interior of buildings is given out from time to time without charge, in bulletin form. The regular serial bulletins of the Scientific Section of the Paint Manufacturers' Association are still being carried on.

Consultation upon special problems which demand investigation work will be undertaken for clients at charges commensurate with the service. The study of oils, oil substitutes, thinners, primers, driers, and waterproofing compounds represents an important branch of the work of this Division, in which its services are available. This Division cooperates with the other Divisions in working out the best treatment for protecting various materials of construction, among which may be instanced protective coatings for the industrial metals, particularly iron and steel, and cement mortar and concrete structures.



VIEW OF ONE OF THE CHEMICAL LABORATORIES

DIVISION OF FOODS AND AGRICULTURAL CHEMISTRY

CHARLES A. GRAMPTON, M. D., PH.C., in Charge of Division

THIS DIVISION handles all problems relating to the manufacture and marketing of food products. Within the past few years much legislation has been enacted regulating the production and sale of materials and preparations intended for use as food. The Food and Drugs Act and the Meat Inspection Act under the control of the United States Department of Agriculture, the Oleomargarine Law, and the tariff acts relating to tea, under the Treasury Department, may be cited as instances of Federal laws of this character, and most of the States have enacted laws governing either dairy products or food products in general. Proposed legislation is now before committees of Congress which, if enacted into law, would very greatly extend existent governmental control over commerce in food products.

This Division of the Institute is admirably equipped for dealing with all matters arising under present or proposed laws controlling or regulating the manufacture and sale or the importation for sale of food products. It will undertake cases for clients before the Board of Food and Drug Inspection, the various Departments of the Government charged with the execution of such laws, and the Federal Courts. It will represent individual clients or groups of manufacturers before Committees of Congress, concerning impending legislation, and it will give advice to manufacturers and dealers in regard to meeting the requirements of food control by changes and improvements in methods of manufacture, handling, labeling and marketing. In addition to matters arising under the various

laws, the Institute solicits correspondence in regard to all possible investigations connected with the food industries in the direction of improvements, economies, utilization of waste materials, development of new products, etc. Problems common to entire lines of industries are particularly desired.

This Division has specialized quite extensively in the analysis of soft drinks and soda-water beverages, and, as a result, has become equipped with all the apparatus necessary for analytical and research problems in this field. The staff of this Division have specialized to a considerable extent in research work on tea, coffee, and coloring matters used in food products. Researches are now being conducted in order to improve the processes of analyzing teas and coffees and for identifying the coloring matters occurring in food products. Toxicological and bacteriological work is also carried out in this Division. A subdivision is now being established to carry on work in fermentology.

The efficiency of the Division in dealing with matters of Government control of food products is greatly enhanced by the long experience of the men in charge of this work, in the branches of the Government which deal with the laws pertaining to such regulation.

The Chief of the Division, Dr. Charles A. Crampton, served twenty years as Chief Chemist of the Internal Revenue Bureau of the Treasury Department, and prior to that time several years as Dr. Wiley's principal assistant in the Bureau of Chemistry of the Department of Agriculture. While in the Department of Agriculture he participated in the investigations (see Bulletin No. 13) which furnished the foundations for the present Pure Food and Drug Act, and in the Treasury Department he had charge of the technical administration of the laws taxing various food and drug products, such as oleomargarine, renovated and adulterated butter, fermented and distilled liquors, sugar, etc. He is also thoroughly familiar with customs matters, having served on numerous commissions for fixing drawback rates, etc., which equips him for expert work before

Customs Courts and the Tariff Commission. He is especially expert in his knowledge of the operation of the denatured alcohol law, having had charge of its administration since its inception, and having made three trips to Europe for the Government in connection with its enforcement. In addition to his knowledge of the various laws, Dr. Crampton is thoroughly qualified to take charge of all possible investigations connected with the food and drug industries, and his services are available for general work involving organic analysis of the highest character.

DIVISION OF DRUGS

HENRY C. FULLER, B. S., in Charge of Division

This Division was created for the purpose of handling the several classes of problems connected with drug and pharmaceutical chemistry and with those industries concerned with the manufacture of insecticides and disinfectants.

The location of the Institute in Washington and the personal acquaintance of its staff with Government officials and familiarity with departmental detail, has proven of signal advantage to manufacturers whose products are affected by federal laws; thus we undertake to criticise labels of drug products, insecticides, etc., and to confer with the officials of the various departments regarding a form which would be satisfactory in every respect, and to report to the client the results of the investigation. Furthermore, the importance of having a technical representative at departmental hearings has become more and more manifest, and for such appearances we are ably fitted. In addition to the above, this Division is equipped to perform check analyses of preparations which have been made the basis of prosecution; to advise with attorneys regarding the chemical features of cases which are being brought to trial; and to furnish its staff to act as expert witnesses in cases involving chemical questions. Importations of foreign drugs and supplies of domestic growth are examined and certificates of their quality issued. Conferences will be held with departmental officials with reference to formulas and labels of new products in order that the manufacturer may be assured that all compliances with regulations have been observed. We also contract to post our clients promptly regarding all new regulations and information having to do with their particular line, and this field is in a state of rapid development.

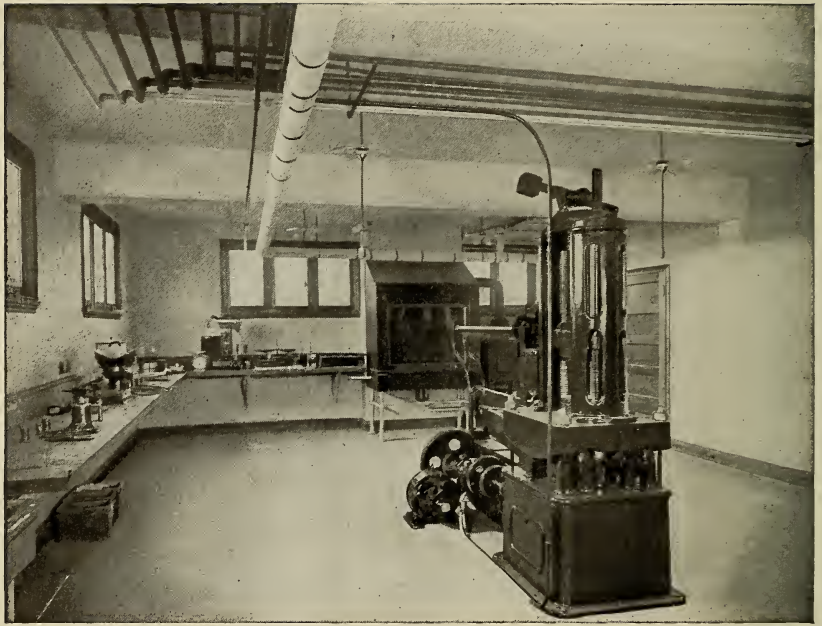
In the manufacturing field this Division is prepared to work out new formulas for different classes of drug products; to improve old formulas and prescriptions, especially with reference to their permanency and attractiveness as commercial articles; to report on manufacturing processes;

and to furnish manufacturing pharmacists with methods for the preparation of their standard chemicals such as aloin, podophyllin, acetanilid, adeps lanæ, iodides, sodium salicylate, etc. Control work is undertaken and new assay methods evolved, for it often happens that a concern confronted with a peculiar and complex mixture is unable to arrive at a satisfactory method of analysis, and this Division takes up the problem and furnishes a reliable method for arriving at the data desired. Correspondence is also solicited in regard to possible investigations in the direction of the utilization of waste materials.

This Division has been especially concerned with the study of the chemistry of alkaloids and virulent poisons generally, and offers its services in toxicological investigations. In conjunction with this work, equipment has been installed for handling clinical investigations.

The importance of research work on the problems connected with manufacturing pharmacy, and especially in the line of lowering the cost of manufacturing and of crude material, is becoming more and more manifest. The Institute has made a careful study of the situation, and offers its services to individual firms, associations of manufacturers, and associations of wholesale and retail druggists desirous of a solution of these larger problems.

The Chief of the Division, Mr. Henry C. Fuller, was employed in the Bureau of Chemistry about five years before becoming connected with the Institute, during which time he testified as an expert witness for the Government in many cases of prosecution under the Food and Drugs Act. Prior to his connection with the Bureau of Chemistry he was in the employ successively of large drug manufacturing concerns, such as the Mallinckrodt Chemical Works and Parke, Davis & Company, for a period of four years. He has published a number of papers on the assay of medicinal products and pharmaceutical problems, and is the author of "The Qualitative Analysis of Medicinal Preparations." He has, therefore, had experience both in practical commercial work and in Government control work, giving him a breadth of training which has fitted him most thoroughly for the work of the Institute.



CEMENT AND TESTING LABORATORY

DIVISION OF ROADS AND PAVEMENTS AND MATERIALS OF CONSTRUCTION

PRÉVOST HUBBARD, in Charge of Division

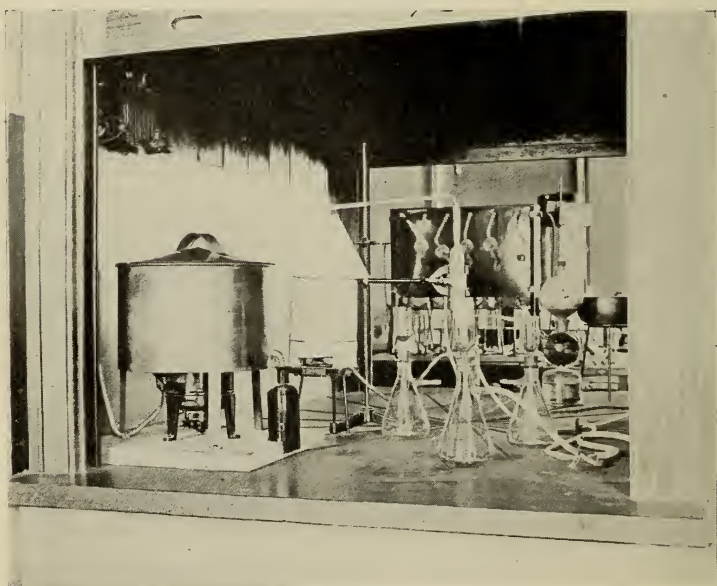
TWO WELL-EQUIPPED laboratories have been given over to this Division, the "Cement and Testing Laboratory" and the "Bitumen Laboratory."

The "Cement and Testing Laboratory" is located in the basement and is a large, well-lighted room with cement concrete floor, measuring 700 sq. ft. It is equipped with the usual laboratory benches and hood, and contains a 150,000-pound motor-driven Riehle Testing Machine, a Fairbanks Cement Testing Machine of the latest improved construction, a moist closet, steam chamber, storage tanks and muffle-furnace, together with a complete cement testing outfit. This laboratory is devoted to the physical testing of cements, rocks, clays, brick, block, iron, steel, wood, rubber and other materials of construction.

The "Bitumen Laboratory" is located in the southeast corner of the second floor, and is twelve by twenty-four feet. It contains an alberene stone top laboratory table, alberene stone working shelves along the walls, two large alberene stone hoods, one for general use and the other for distillation and extraction work with inflammable solvents. All of the working space is piped for gas, water, blast and vacuum, and is wired for electrical connections. The equipment is thoroughly complete and up-to-date. Among other things may be mentioned the following apparatus: A penetration machine, float test apparatus, a motor-driven ductility machine, a motor-driven extractor for bituminous aggregates, an Office of Public Roads melting point apparatus, viscosimeter, flash and fire testers, a cold chamber,

an oven for volatilization tests equipped with a gas regulator, hot plates, a sulphur determination apparatus, and hot and cold extraction apparatus. In addition, it is well equipped with glass, porcelain, platinum and iron ware, and reagents for the usual chemical work.

In this laboratory petroleum and petroleum products, tars and tar products, creosoting oils, asphalts, bituminous emulsions, bituminous aggregates and all other types of chemical road and paving materials, roofing materials, rubber, etc., are examined and tested. Chemical examina-



EXTRACTION HOOD—BITUMEN LABORATORY

tions of rocks, clays, cements, etc., are made here, and researches conducted on improvements in industrial products and processes and the utilization of waste products for road purposes. The testing and analysis of coal and investigations relating to all classes of fuels are also conducted in this laboratory.

This Division of the Institute is under the supervision of Mr. Prévost Hubbard, who was formerly Chief Chemist of the Office of Public Roads, United States Depart-

ment of Agriculture. Mr. Hubbard is the author of "Dust Preventives and Road Binders" and of many other publications on similar subjects. He has had wide experience in the examination and use of all types of road and paving materials, and has been engaged as lecturer on engineering chemistry in the new post-graduate course in highway engineering at Columbia University. For the past two years he has served in the capacity of Consulting Chemical Engineer and as a member of the Advisory Board to the New York State Department of Efficiency



CORNER OF BITUMEN LABORATORY

and Economy. His work in this connection has had to do mainly with investigations relative to the improvement of highway matters in New York State.

This Division is engaged in an important investigation of the relative value of different types of road and paving materials under various local conditions, and the inspection and supervision of roads and pavements of all types and their materials of construction. It is prepared to furnish specifications and advice regarding road and

paving problems, and also improvements of materials and processes relating to the road and paving material industries. The Division also engages in the preparation of expert evidence to be used in litigation when the purposes of clients are thoroughly straightforward and honest.

The Institute invites to this Division the attention of all public services bodies, associations, corporations and individuals who are interested in the manufacture and use of cements, concretes, road and paving materials and all other materials of construction. The interests of all clients of the Institute are carefully and loyally guarded in every way.



A CORNER OF THE PHYSICAL AND ELECTRICAL ENGINEERING LABORATORY

DIVISION OF ELECTRICAL ENGINEERING, PHYSICS, AND ELECTROCHEMISTRY

NEVIL MONROE HOPKINS, M. S., PH.D., in Charge of Division

THIS DIVISION of the Institute is prepared to undertake experimental work in the field of applied electricity, physics and electrochemistry; to assist inventors in developing their ideas, machines or processes; to furnish scientific data to the Patent Office for such clients in cases of complicated applications, and to give expert testimony in patent litigation. The design of scientific instruments is made a specialty, as well as tests of motors, generators, transformers, lamps, primary and storage batteries, lightning arresters, protective devices, fuses, circuit breakers, high and low tension magnetos, etc., etc. Certificates of tests will be furnished by the Institute when this is justified by the circumstances and the performance of the device warrants it. Special attention will also be given to all classes of electric automatic devices, and materials used in the various electrical arts and manufactures. In the field of heavy electrical engineering, the Institute is prepared to supply complete designs of central stations for light and power, as well as designs for isolated plants for towns and country residences. The preparation of specifications and the purchase for clients of materials in the foreign or domestic market is made a specialty. The laboratories of the Institute are equipped with standard instruments of precision for various kinds of electrical currents, direct and alternating, single and polyphase, of all commercial voltages and frequencies. Provision is also made for high voltages for the testing of insulation, and insulating compounds at commercial frequencies, as well as for very high voltages at high frequencies. Direct current of heavy amperage is available for welding, electrical furnace work, for making permanent magnets and for metallurgical and electrochemical processes. The experimental department includes every type of electrical measuring instrument;

such as ammeters, voltmeters, wattmeters, dynamometers, for both alternating and direct current, alternating and direct current comparators, oscillographs for wave form determinations of electro-motive force, current and power. Standards of resistance, inductance and capacity of the most approved pattern, also form a part of the equipment. Facilities for the testing of the magnetic properties of iron and steel are provided for, as well as constant and variable temperature space for studying the electrical properties of alloys. The equipment includes facilities for work in the field of wireless telegraphy and telephony, Roentgen rays, very high electrical pressures at high frequencies, and for experiments in electrical discharges through gases. Investigations and experiments at high and low temperatures can also be undertaken.

The Division is under the immediate charge of Dr. Nevil Monroe Hopkins, who has had special training and practical experience in the field of electrical engineering, applied physics, electrochemistry, and general experimental work. Dr. Hopkins first studied the physical sciences during eight years spent in Germany and France. After this, he worked through the shops and various departments of the General Electric Company, at Schenectady, New York. After a number of years in machine shop and practical testing work, Dr. Hopkins took up university studies, specializing in physics, chemistry and electrical engineering at the Corcoran Scientific School and at Columbia and Harvard Universities, taking successively the degrees of Bachelor of Science, Master of Science, and Doctor of Philosophy. Dr. Hopkins has been associated for many years with Professor Charles E. Munroe as an assistant, later as Instructor and Assistant Professor in the School of Graduate Studies of The George Washington University. Dr. Hopkins has worked successfully upon a large number of electrical and physical problems for many large corporations, municipalities and individuals, and has been instrumental in the perfecting of a number of noteworthy electrical inventions. He was appointed Electrical Engineer in the U. S. Navy

Department by Ex-President Roosevelt, on account of the Consolidation of Power Plants at all Navy Yards and Naval Stations, and had to do with the entire field of electricity ashore in the Navy, in designing central power stations, lighting systems, the driving of heavy and light machine tools by electric motors and the writing of standard specifications for all classes of electrical apparatus. Dr. Hopkins was appointed Mechanical Expert in the U. S. Office of Public Roads subsequent to the completion of the Navy work. He is the author of numerous scientific articles and books.

DIVISION OF MILL PROBLEMS

GEORGE W. COGGESHALL, Ph.D., in Charge of Division

INDUSTRIAL RESEARCH demands the fullest cooperation between the producer or manufacturer and the investigation laboratory. It frequently becomes necessary to adapt laboratory results to the mill scale of operation, and in addition to this many problems are best studied in the actual field of manufacturing operation. The Division of Mill Problems has been organized to deal particularly with this phase of the work. The Division is under the supervision of Dr. George W. Coggeshall, who is especially fitted by education and training to direct this work. Dr. Coggeshall received his bachelor's degree at Grinnell, in 1890; he then went to Germany and took his doctorate under the celebrated Professor Ostwald, at Leipzig. He was for several years instructor in Physical Chemistry at Harvard University, and for the following ten years was engaged in manufacturing and applied chemistry. A specialty is made of designs and estimates for modernizing old industrial plants and the construction of new ones. The adaptation of patented processes and products to the commercial scale of operation is a branch of the work which it is believed will be found useful by inventors and capitalists who are attempting to develop new lines of industry or improve old ones. Dr. Coggeshall's special training, taken in conjunction with the broad field covered by the various Divisions of the Institute, is a guarantee of efficient service along these special lines.

This Division has been engaged on a number of problems of a highly important nature, some of which have been successfully solved, while others are developing very interesting results. It is believed that the coordination of theory with practice, that is made possible by this Division, will be appreciated by producers and manufacturers who wish to broaden or reduce the costs of their production by availing themselves of the latest and best scientific methods.

REPORTS AND PUBLICATIONS

THE INSTITUTE issues from time to time printed bulletins, circulars and reports containing the results of investigation or covering some special field of information. In addition to the printed matter, typewritten reports are furnished to clients on special investigations. Following the practice of the best laboratories, such reports are ordinarily submitted with the understanding that they are not to be used for advertising purposes except in cases in which special arrangement to this end has been made and in which due regard to dignity and ethical principles has been taken into consideration.

PUBLICATIONS OF THE INSTITUTE OF INDUSTRIAL
RESEARCH, WASHINGTON, D. C.

- Announcement Circular, December, 1910.
- Announcement Circular (Food and Drug Division), December, 1910.
- Bulletin No. 1. The Preservation of the Exterior of Wooden Buildings, by Allerton S. Cushman and Henry A. Gardner.
- The Conservation of Iron, by Allerton S. Cushman. Reprint from the Jour. of The Franklin Institute, April, 1911.
- Announcement Circular (Division of Roads and Pavements).
- Bulletin No. 2. The Sanitary Value of Wall Paints, by Henry A. Gardner.
- Circular No. 1. Paints for Cypress and Their Necessity, by Henry A. Gardner.
- The Practical Testing of Drying and Semi-drying Paint Oils (Washington Test Fence); Report of Subcommittee C on Paint Oils; Report of Subcommittee D on the Atlantic City Steel Paint Tests. Reprint from the Proc. Amer. Soc. for Test. Materials, Vol. XI, 1911.
- Circular No. 2. The Effect of Color upon the Durability of Paint, by Henry A. Gardner.
- Bulletin No. 3. The Institute of Industrial Research of Washington, D. C. Scope and Organization.
- What Makes White Lead Chalk and How Chalking may be Prevented, by Henry A. Gardner. Reprint from the Jour. of The Franklin Institute, January, 1912.
- The Determination of Oxygen in Iron and Steel, by Allerton S. Cushman. Reprint from the Jour. of Indus. & Engrg. Chem., Vol. 3, No. 6, June, 1911.
- The Effects of Pigments Ground in Linseed Oil, by Henry A. Gardner. Reprint from the Jour. of Indus. & Engrg. Chem., Vol. 3, No. 9, September, 1911.
- The Value of Certain Paint Oils, by Henry A. Gardner. Reprint from the Jour. of The Franklin Institute, January, 1911.
- The Manufacture of Pure Irons in Open-Hearth Furnaces, by A. S. Cushman. Reprint from the Proc. of the Amer. Soc. for Test. Mater., Vol. XI, 1911.
- Paints for Metallic Structures. Official Report by Allerton S. Cushman, Washington. Advance reprint from transactions of VIth Congress, New York, 1912, International Association for Testing Materials.
- Circular No. 4. Certified Analyses of Bituminous Road and Paving Materials for Highway Engineers and Contractors.
- The Effect of Pigments upon the Constants of Linseed Oil, by Henry A. Gardner. Reprint from Jour. of The Franklin Institute, October, 1912.
- The Rarer Paint Oils, by Henry A. Gardner. Reprinted from Original Communications, Eighth International Congress of Applied Chemistry.
- A Chemical Investigation of Asiatic Rice, by Allerton S. Cushman and Henry C. Fuller. Reprinted from Original Communications, Eighth International Congress of Applied Chemistry.
- Notes on a Study of the Temperature Gradients of Setting Portland Cement, by Allerton S. Cushman. Reprinted from Original Communications, Eighth International Congress of Applied Chemistry.

- The Decoration of the Interior of Hospitals and Public Buildings, by Henry A. Gardner. Reprinted from The Journal of the American Medical Association, February 3, 1912, Vol. LVIII, pp. 338 and 339.
- Notes on the Formation and Inhibition of Mildew in Paints, by Henry A. Gardner. Reprinted from the Journal of The Franklin Institute, January, 1913.
- The Production of Available Potash from the Natural Silicates, by Allerton S. Cushman and George W. Coggeshall. Reprinted from Original Communications, Eighth International Congress of Applied Chemistry.
- An Electrolytic Method for the Determination of Tin in Canned Food Products, by Allerton S. Cushman and Everett B. Wettengel. Reprinted from the Journal of Indus. & Engrg. Chem., Vol. 5, No. 3. March, 1913.
- Bulletin No. 4. Bituminous Roads and Pavements and Their Materials of Construction. By Prevost Hubbard.
- Bulletin No. 5. Pure Iron *vs.* Copper-bearing Steel. By Allerton S. Cushman.
- Bulletin No. 6. Conservation and Its Relation to Pharmaceutical Chemistry. By Henry C. Fuller.
- The Composition of Paint Vapors. By Henry A. Gardner. Reprint from the Jour. of Indus. & Engrg. Chem., Vol. 6, No. 2, Feb., 1914.
- Modern Research in the Metallurgy of Iron. By Allerton S. Cushman. Reprint from the Journal of The Franklin Institute, Aug., 1914.

BOOKS PUBLISHED BY MEMBERS OF STAFF.

- Paint Technology and Tests, by Henry A. Gardner. McGraw-Hill Book Co., New York, 1911.
- Corrosion and Preservation of Iron and Steel, by Allerton S. Cushman and Henry A. Gardner. McGraw-Hill Book Co., New York, 1910.
- The Analysis of Paints and Painting Materials, by Henry A. Gardner and John A. Schaeffer. McGraw-Hill Book Co., New York, 1910.
- The Qualitative Analysis of Medicinal Preparations, by Henry C. Fuller. John Wiley & Sons, New York, 1912.
- Dust Preventives and Road Binders, by Prevost Hubbard. John Wiley & Sons, New York, 1910.

PUBLICATIONS OF THE SCIENTIFIC SECTION, PAINT MANUFACTURERS' ASSOCIATION OF THE UNITED STATES.

- Bulletins Nos. 1 to 30, inclusive, now out of print.
- Bulletin No. 31. Report on the Repainting Tests at the North Dakota Agricultural College, 1910, by Leo P. Nemzek. Published by the Secretary, 636 The Bourse, Phila.
- Bulletin No. 32. Notes on a Recent Study of the Atlantic City Steel Paint Tests. Published by The Institute of Industrial Research, Washington, D. C.
- Bulletin No. 33. Address of Dr. David Fairchild, Chief Plant Explorer, Bureau of Plant Industry, U. S. Dept. of Agriculture, on The Cultivation of the Tung Tree (China Wood Oil) in the U. S. Notes on the Properties of Chinese and Japanese Lacquer, by Henry A. Gardner. Published by the Secretary, 636 The Bourse, Philadelphia, Pa.
- Bulletin No. 34. Report of the 1912 Inspection of the Atlantic City Wooden Test Fence, including the Repainting Tests and the New Tests. The Institute of Industrial Research.

- Bulletin No. 35. Report of the 1912 Inspection of the Pittsburgh Test Fence, including the Repainting Tests and the New Tests. Published by The Institute of Industrial Research, Washington, D. C.
- Bulletin No. 36. Report of Inspection of the Tennessee Test Fence. Published by The Institute of Industrial Research, Washington, D. C.
- Bulletin No. 37. Primers for Metals, by Henry A. Gardner. Published by the Secretary, 636 The Bourse, Philadelphia, Pa.
- Bulletin No. 38. Surfaces and Colors for Hospitals and Schools. An Address by Alfred C. Rapp.
- Bulletin No. 39. General Report on North Dakota House Repainting Tests, 1912. By L. P. Nemzek.
- Bulletin No. 40. Annual Report of Committee D-1 (on Preservative Coatings), 1913, American Society for Testing Materials.
- Bulletin No. 41. The Toxic and Antiseptic Properties of Paints. By Henry A. Gardner.
- Bulletin No. 42. Fire Retardant Paints for Shingles. By Henry A. Gardner.
- Bulletin No. 43. Changes Occurring in Oils and Paste Paints. By Henry A. Gardner.
- Bulletin No. 44. Paints for Impregnated Wood.
- Bulletin No. 45. Report of Committee D-1, A. S. T. M., 1914.
- Circular No. 1. Shellac Priming Coat and a Consideration of the Practice of Shellacking Knots and Sappy Places.
- Circular No. 2. Comparison of Service Condition of Two Coat and Three Coat Work.
- Circular No. 3. Ready Mixed Paints in the U. S. Navy.
- Circular No. 7. Paint for Steam and Hot Water Radiators.
- Circular No. 8. Painting Cement and Concrete.
- Circular No. 9. Paint Protection and Its Economy.
- Circular No. 10. The Increasing Use of Wall Paints.
- Circular No. 11. Report on Tests Conducted at Washington.
- Circular No. 12. Tests on Young's Million-Dollar Pier, Atlantic City, N. J.
- Zinc, Lithopone, and Lead. By Henry A. Gardner.
- Circular No. 13. Painting Wall Board.
- Circular No. 14. Standard Specifications for the Purity of Raw Linseed Oil from North American Seed.
- Circular No. 15. Paint as an Asset.
- Circular No. 16. The Use of High-Grade Paints as Preservatives for Dwellings, Barns, and Shingled Structures.
- Circular No. 17. Metal Primer Tests.
- Circular No. 18. The Growth of the Prepared Paint Industry and Its Effect upon the Painter.
- Circular No. 19. Paint as an Investment.
- Circular No. 20. Painting—Poem by Walt Mason.
- Circular No. 21. The Advantages of High-Grade Prepared Paint for Repainting Dwellings and Similar Structures.
- Circular No. 22. The Effect of Zinc White in House Paints.
- Circular No. 23. Rust-Inhibitive Paints for Metal Structures.
- Circular No. 24. Prepared Paints for Cement Surfaces.
- Circular No. 25. The Necessity of Painting Wooden Structures.
- Circular No. 26. Sanitary Properties of Paint Vapors.



LIBRARY OF CONGRESS



0 019 662 059 A